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Scientific Discovery and the Scientist's Gaze: Galileo's Lunar Science and the Lacanian Theory of Art

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Abstract
One dominant explanation for Galileo's telescopic discovery of the rough and uneven surface of the moon is that he was well-versed in painting techniques such as perspective and chiaroscuro, which emphasize a realistic representation of objects. This allowed him to grasp the appearance of the moon most accurately. This paper proposes a new interpretation of the relationship of science and art through the Galilean case, which highlights the creative process rather than realistic representation as they pertain to the beneficial role of art in advancing science. Tracing the trajectory of Galileo's telescopic observation as described in *Sidereus Nuncius*, the author demonstrates that what Galileo saw were simply unidentifiable spots and that the discovery of the moon's rough surface was an inference—the key factor being a self-distancing imagination that allowed him to see, at an imaginary distance, the homogeneous relationship of the moon and the earth to the sun. The author discusses how this self-distancing imagination, which involves re-establishing the relationship of objects through light, is uniquely connected to pictorial artistic sensibility, especially through the Lacanian theory of art. Finally, the author suggests that a love for numerous partial objects, rather than for truth, constitutes the real ethical foundation of a scientist.

Keywords: Galileo Galilei, the moon, science and art, Jacques Lacan, the gaze

1. Galileo: Scientist and Artist, a Reconsideration

Galileo Galilei is often referred to as the father of modern science, as he pioneered an experimental scientific method to advance human knowledge of the world. He was among the first to observe the moon by means of a telescope, a highly advanced scientific instrument at the time. More importantly, Galileo made important astronomical discoveries that ran counter to the established notions of the Early Modern period. According to Aristotelian cosmology, which dominated the discourse on the moon's topography before Galileo, the earth was the fixed center of the universe, with the moon being one of the many heavenly bodies revolving around it in a perfect circular motion. In the Aristotelian schema, people believed the moon was in radical distinction from the sublunary earth and had a smooth and polished surface, similar to that of a crystal ball. Although some imperfections on its surface are visible to the naked eye, people either ignored them or ideationally explained them away because they did not align with the Aristotelian assumption of the perfection of heavenly bodies.[i] However, by turning his telescope toward the moon and pushing back against this long-held belief, Galileo discovered that the lunar surface is neither smooth nor polished. Rather, in his own emphatic words from *Sidereus Nuncius,* the first publication of Galileo's lunar observations, the moon is "rough and uneven [. . .] like the face of the Earth itself" (Galilei, [1610] 1989, pp. 6, 13). To prove his theory, Galileo sketched what he observed, creating seven watercolor sketches of the moon in its various phases, as seen in Figs. 1 and 2.[ii] He also created engravings based on the water sketches and used them for illustration in his book, as seen in Fig. 3, adding detailed explanations along with presentations of his other discoveries. His discovery of the rough lunar surface was scientifically important because it was an initial indication that the Aristotelian dichotomy between the heavenly and the earthly was no longer valid, thus opening up a new perspective on the center of the universe. This, in turn, laid the cornerstone for the Scientific Revolution.

Figure 1: Galileo, wash drawings of the moon (1609). Ms. Gal. 48, fol. 28r Courtesy of the Biblioteca Nazionale Centrale, Florence.

Figure 2: Galileo, wash drawings of the moon (1609). Ms. Gal. 48, fol. 29v Courtesy of the Biblioteca Nazionale Centrale, Florence.

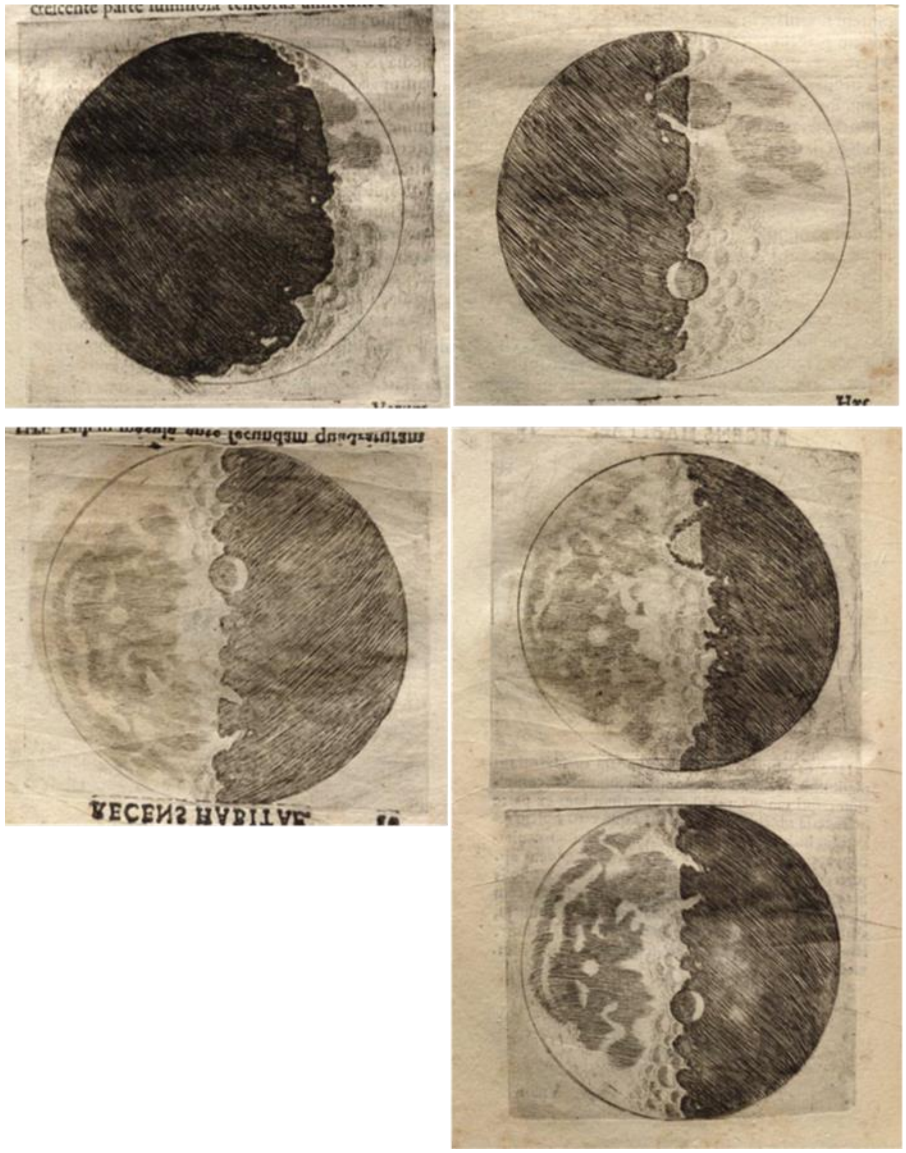

Figure 3: Galileo, drawings of the moon as they appear in *Sidereus Nuncius,* [1610] 1989.

The Galilean discovery has garnered much attention, not just from scientific minds but also from philosophical ones. About six months before Galileo's discovery, the English scientist Thomas Harriot had also observed the moon with a telescope. Likewise, he also sketched lunar features, depicting stains and even a jagged borderline, as seen in Fig. 4. Although his sketch was not that much more specific than what the human eye could observe, perhaps because of the poor quality of his equipment,[iii] it does have similarities to Galileo's in that it depicts what is objectively observable, not what was believed to exist. However, in spite of this impressive observation, Harriot recognized nothing scientifically important in what he observed; nor did he leave behind any notes on his sketch or consider publishing it (Bloom, 1978, p. 117).[iv] Thus, although the two scientists observed the same moon aided in a similar manner, each saw very different things: Galileo saw a new perspective of the moon, fraught with scientifically revolutionary implications and the other saw the same moon, in such a way that did not challenge the accepted paradigm.

In this regard, Galileo and Harriet raise important questions from the philosophical perspective: What personal and subjective factors separate Galileo's science from Harriet's? What distinguishes one scientist's vision leading to a revolutionary scientific discovery?

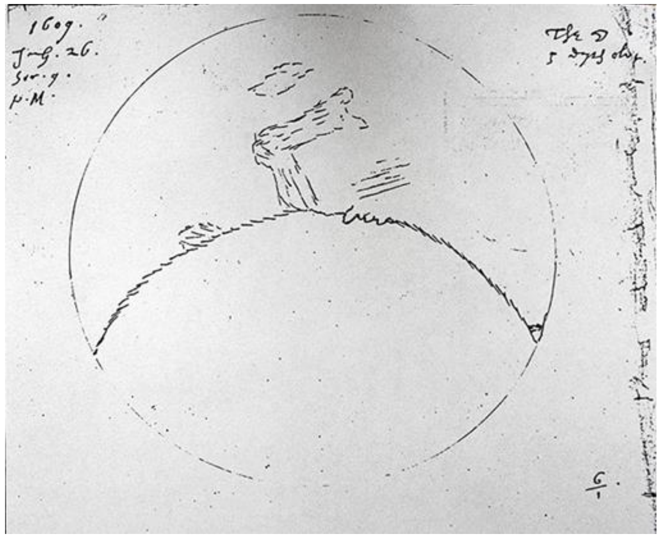

Figure 4: Harriot, a lunar sketch (26th July 1609). Petworth House Archives HMC 241/IX f. 26. Courtesy of Lord Egremont and Leconfield.

Many researchers have tried answering these questions, and the prevailing explanation at present relates to Galileo's artistic aptitude. Notably, Galileo was considerably talented in the arts, such as literature, music, and painting. He was also particularly skilled in painting, to which he once desired to devote himself (Gattei, 2019, p. 7). In fact, he was close with Lodovico Cigoli, a talented and famous Florentine painter, and the two exchanged opinions on art and science.[v] Thus, Galileo had likely mastered the painting techniques of perspective and chiaroscuro developed during the Renaissance. Because Galileo understood the painting techniques that emphasize three-dimensional realistic representation using distance-dependent scaling in size and shading, it was, therefore, possible for him to grasp accurately the moon's appearance.

Samuel Y. Edgerton is one such scholar that offers this kind of explanation. Claiming that Giotto's geometry (of the fourteenth century) catalyzed the development of perspective in painting during the Renaissance, Edgerton argues that perspective, in turn, had a decisive influence on advancing modern science by letting the physical world as three-dimensional space "finally enter the human eye" and be affiliated in the brain (1991, pp. 43-44). Galileo's lunar science is an ideal example of this interconnectivity of artistic development and scientific advancement. Thus promoting the beneficial reciprocity of science and art in the Early Modern era, Edgerton emphatically argues that one of the factors of Galileo's success was his "photographic realism" (ibid., p. 21), which, distinctly, is often accompanied by contempt elsewhere.

Following Edgerton, many scholars hold similar opinions. Most prominently, Horst Bredekamp, in his article in 2000, noting the necessity of "the mathematical training of the artist" at Galileo's time, argues that "Galileo could see better because he was better prepared by his artistic training and knew how to draw" (2000, p. 179). He refers to Galileo as a "draftsman" and argues that, on that basis, Galileo had an artistic prejudice that contributed to his blindness to Kepler's finding that orbits are elliptical (ibid., pp. 184–87). More recently, in a book in 2019, Bredekamp advances his previous perspective into the argument that Galileo's drafting hand was, in fact, a thinking hand rather than a copying one as he reached his conclusion on the lunar surface through artistically trained analysis and reflection (2019, pp. 3, 76, and passim). Though it contributes to removing the tag "photography" in the current discussion of the issue, this new perspective, which I will address again in places below, seems to be still within the scope of Edgerton's thesis of realism as it adheres to the concept of a correct correspondence between object and representation. Likewise, Filippo Camerota also contends that "the concepts of *measure and representation* developed within the context of Renaissance studies in perspective" were "an essential part of the new visual astronomy" (2004, p. 14; emphasis in the original). Dean Keith Simonton, concurring with the thesis of photographic realism, interprets it rather as evidence of the contingency of science (2012). Furthermore, as many articles and lectures uncritically mention his artistic talent in recourse to the realism thesis (Harris, 2010; Enríquez, 2014; Falk, 2013; Hong, 2016), the question of how art and science interact seems, to our scholarly detriment, to have earned a standard answer that warrants no further discussion.

This article aims to fill this gap in the academic literature by proposing a new interpretation of the relationship of science and art through the Galilean case, which highlights the creative process rather than realistic representation as they pertain to the beneficial role of art in advancing science. This paper basically agrees that, in the Early Modern era, drawing played an important role in studying celestial bodies: without modern photographic technology, drawing was the only way to record an image one saw via a telescope. Also, the technique of perspective certainly changed the way one represented the world. However, for the following reasons, I also contend that it would be one-sided to argue that Galileo made his scientific discoveries solely on the basis of his artistic ability to reproduce a realistic image of an object.

The realism thesis is a typical instance of a retrospective insight. Today, we know the lunar surface is rough and uneven and, as Edgerton illustrates with high-quality photographs (1991, pp. 237, 244), it is verified that most details of Galileo's drawings—if not all of them—are incredibly accurate. As a matter of fact, as seen in the Figs above, the engravings do not exactly replicate the watercolor sketches. As Edgerton surmises, at the stage of engraving, Galileo certainly had "the more spectacular features of the moon's surface" emphasized (1991, p. 243). One of Bredekamp's main arguments is also that Galileo introduced changes to lunar images in the etching process for the sake of clarity (2019, pp. 132-171). Nonetheless, when he published his lunar observations, Galileo failed to convince people of the scientific fact solely based on his drawings. At first glance, the depiction of the moon in the drawings, either published or not, looks nothing like what Aristotelian thought had claimed—a smooth and perfect body. However, it does not say specifically that the lunar surface is uneven. Rather, as for the engravings, the overall image is "elusive"—as T. F. Bloom remarks (1978, p. 121). And, as for the watercolors, they look "impressive" in the words of Lawrence Lipking (2014, p. 34). Moreover, because the lunar stains are always visible to the human eye, it was possible to rationalize them away. For opponents, the telescope's unreliable power and performance were also an issue: if the lunar surface in the drawings looks uneven, it is because we know it is.[vi]

Galileo's heliocentric theory gained credibility regardless of the accuracy of his drawings. Generally, it is accepted that, with the publication of Newton's *Principia* in 1687, heliocentrism came to have a solid theoretical foundation. On the other hand, Galileo's drawings were still questioned for their accuracy well into the late twentieth century. Finally, to clear the doubt, in 1975, Guglielmo Righini examined the distances and degrees in Galileo's lunar drawings and concluded that Galileo was "in fact, a remarkably faithful recorder of his visual experiences" (1975, p. 76). This example supports the idea that scientific truth is independent of an object's realistic representation.

If artistic talent includes knowledge of realistic reproduction, it is a kind of technical draftsmanship, as Bredekamp explains, which is an engineering principle rather than an artistic one. In that case, the question arises whether all painters who have mastered the same technique of perspective would have arrived at the same scientific discoveries as Galileo. If artistic aptitude is beneficial to scientific discovery, then how should other artistic talents, such as being well-versed in literature and trained in music, be understood? Should we distinguish one from the others? Or is there a way of understanding one as a model for the others? "The Galileo Affair" was a series of dogmatic and political conflicts between science and religion that erupted over Galileo's support of heliocentrism. According to relevant records, Galileo withdrew his heliocentric theory in the face of severe persecution. This poses the question: What should the ethics of a scientist be? Does an understanding of the relationship between science and art illuminate this other philosophical issue? In this paper, I argue that the realism thesis is too limited to address these vital questions fully.

I thus propose to address again the science-art relationship in Galileo's lunar science through the lens of Lacan's art theory. Lacan's contribution to the theory of perspective is particularly important.[vii] In particular, it balances the biased reception of Panofsky's theory of perspective that most of the advocates of the realism thesis, whom I cited above, refer to. Panofsky understands perspective as a symbolic form that "transforms psychophysiological space into mathematical space," with the differences among objects abstracted into equal relations of points (Panofsky [1927] 1991, p. 31). In establishing a connection between perspectival representation in art and the objectification of subjective cognition, Panofsky seems to endorse the realism thesis. However, his further point argues that perspective catalyzed the expansion of subjectivity in that it relativizes the spatial center by allowing the vanishing point, at which point the world appears to be centered, to be determined freely (ibid., p. 139, no. 64). He thus ultimately proposes that perspective is "a two-edged sword" that is bound to become "all that much more of an artistic problem" once it ceases to be a technical and mathematical problem (ibid., pp. 66–67). Lacan elaborates extensively and in more radical terms on the artistic problem of perspective. Or, in this context, Lacan approaches the problem of artistic sensibility in contrast to artistic techniques or ability, which Panofsky essentially ignored. Although Lacan's theory also pertains to a duality in the scopic field, for him the duality indicates an inherent split in vision—not only as a limit to objective representation but also as a structural deficit in representation calling for the subject's creative intervention. Given that Lacan provides a challenging new view on perspective, I argue that *reading Galileo's lunar science through the lens of Lacan offers an invaluable alternative to the current conversation, which is oriented toward the technical and mathematical problem.*

Long after his theoretical discussion on perspective, Panofsky developed a practical criticism of Galileo's views on art to study the relationship between aesthetic and scientific thought (1956).[viii]

He concludes that Galileo's classicist attitude, which had been shaped by the paradigm governing aesthetic inquiry at the time, alongside his open antipathy to Mannerist anamorphosis, had directly influenced Galileo's scientific thought—as exemplified by his silence on Kepler's ellipses. This criticism, which remains influential given its echo in Bredekamp, is yet another hindrance to forming a new perspective on the science-art relationship in Galileo's lunar science. This is especially salient given the perspective this article adopts because anamorphosis is, in fact, a subject of focus in a different direction for Lacan. Regarding this, this essay first concurs with Eileen Reeves, arguing that Panofsky interprets Galileo's aesthetic remarks too straightforwardly, without more deeply considering Galileo's astronomical argument (Reeves, 1997, p. 21). I would also refer to Bredekamp's latest book on Galileo's thinking hand. According to Bredekamp, Galileo needed to introduce such changes to his lunar images because he continued observing even after he began the printing process and gained a clearer understanding of his observations while his work was being printed. His lunar science is an effect of "the interplay between schooled perception and drawing reflection" (2019, p. 321). Thus, he contends that, with such non-classical artistic principles applied as scale shifting, compilation, and even the picture puzzle, the etchings are "major works of an analytic Mannerism" (ibid., p. 144). Apart from my admiration for his inspiring details, I am skeptical about refuting the realism thesis through this argument of Bredekamp's for those reasons enumerated above. However, starting at the place Bredekamp hints at the possibility of a new reading of Galileo's science in terms of Mannerism, in this essay, I aim to take the current radical implications of the term, where Bredekamp shows no interest, into full account.

Thus, this study will proceed in the following order. First, it will trace the trajectory of Galileo's telescopic observation as described in *Sidereus Nuncius* in contrast to Harriot's sketch and consider his astronomical arguments more thoroughly. Accordingly, I will demonstrate that what Galileo saw were simply unidentifiable spots and that the discovery of the moon's rough surface was an inference—the key factor being a self-distancing imagination that allowed him to see, at an imaginary distance, the homogeneous relationship of the moon and the earth to the sunlight. Then, I will discuss how this self-distancing imagination, which involves re-establishing the relationship of objects through light, is connected to pictorial artistic sensibility through Lacan's art theory—particularly his notions of the split between the eye and the gaze and the light for the gaze. Finally, through the notion of "*objet a* as the real thing," I will suggest that a love for numerous partial objects, rather than for truth, constitutes the real ethical foundation of a scientist.

2. What Galileo Saw Directly and What He Inferred

Because the realism thesis is based on the premise that Galileo's drawings are a visualization of what he saw directly, it follows that Galileo should have seen the moon's uneven surface. Indeed, Galileo seems to create this impression. For instance, at the beginning of *Sidereus Nuncius*, after briefly mentioning the telescope aiding astronomical inspection, he immediately declares that "Anyone will then understand with the certainty of the senses that the Moon is by no means endowed with a smooth and polished surface, but is rough and uneven and, just as the face of the Earth itself, crowded everywhere with vast prominences, deep chasms, and convolutions" (Galileo, [1610] 1989, p. 9).[ix] Galileo's confident tone and his hinting at direct observation via telescope naturally creates the impression of first-hand observation. Furthermore, the terrestrial image he compares the lunar surface to—"the face of the Earth," which develops more distinctively into the images of "mountains" and "valleys" a few lines below (p. 13)—also strengthens the impression of a direct witness.

However, Galileo is very clear about what he saw directly and what he inferred from it because he immediately adds that "The observations from which this is inferred are as follows" (p. 13). What he actually intends with *Sidereus Nuncius* is to explain how he reached his conclusion of the moon's uneven surface without having ever seen it directly. Perhaps Galileo was so confident about his inference that he may have indeed seen the moon's mountainous face with his mind's eye. If this were the case, then what did he see directly, prior to making this inferential conclusion?

Initially, when Galileo writes about "the face of the Moon that is turned toward our sight," he does not depict it as a bright object with dark spots, as one would expect, given the traditional iconology of the era. Rather, he depicts it as an object composed of "two parts, namely a brighter one and a darker one" (p. 13). What catches Galileo's attention is the contrast of lightness and darkness and the moon essentially appearing to be spotted. The moon does, indeed, look spotted to the naked eye, so Galileo's initial depiction indicates that he sketches the moon just as he observed it. Naturally, he describes "these darkish and rather large spots that are obvious to everyone" as "large or ancient spots" (p. 13). In contrast, those that "were observed by no one before us" (as Galileo was the first to observe additional spots) are "other spots, smaller in size and occurring with such frequency that they besprinkle the entire lunar surface, but especially the brighter part" (p. 13). What are emphatically new in his first observation are the smaller spots, more in number, "besprinkle[ing]" both the dark and brighter parts. Galileo is thus clear that the first things he observed through the telescope were simply more spots than had been seen before. Remembering Harriot's sketch depicting lunar stains, there is no significant difference thus far between the two scientists' observations.

Then, as the first visual evidence of the moon's uneven surface, Galileo references "the boundary dividing the bright from the dark," which "does not form a uniformly oval line, as would happen in a perfectly spherical solid, but is marked by an uneven, rough, and very sinuous line" (p. 13). This jagged terminator, less clear but still visible to the unaided eye, is a logical indicator of the moon's uneven surface. However, given that Harriot drew a similar terminator without being enlightened, it was not convincing enough for opponents of lunar unevenness. In this respect, yet again, there seems to be no great difference between the two scientists' observations.

However, Galileo's science does indeed diverge from Harriot's, and does so at the point where Galileo, unlike Harriot, observes the spots undergoing a process of change. What distinguishes the two scientists, therefore, is whether they attended to the spots' dynamic appearance. When observing the spots scattered around the terminator on the fourth or fifth day after conjunction, Galileo first notes that those in the brighter part (except the large and ancient ones) agree in "[having] a dark part on the side toward the Sun while on the side opposite the Sun they are crowned with brighter borders like shining ridges" (p. 14). Galileo sees that not only the moon itself but also the spots are composed of bright and dark parts, relative to the direction of each part to the sun. Notably, he infers a similarity of the lunar composition of light and darkness in the spots to the earthly one on the mountains based on their change in appearance, which is caused by the changing illumination of the sun's rays.

> we have an almost entirely similar sight on Earth, around sunrise, when the valleys are not yet bathed in light but the surrounding mountains facing the Sun are already seen shining with light. And just as the shadows of the earthly valleys are diminished as the Sun climbs higher, so those lunar spots lose their darkness as the luminous part grows. (p. 14)

To explain the lunar phenomenon, Galileo recalls a similar phenomenon, which he seems to have observed on the earth's mountains: because of the mountains' uneven surface, they implicitly create a similar contrast of lightness and darkness, depending on the position of the sun's illumination. He then attempts to affirm the affinity in reference to another similarity, that is, the likeness in the way the contrast changes depending on the altering position of sunlight. Thus, while strongly suggesting the lunar surface's unevenness, this short passage also displays the essential logical process of Galileo's scientific discovery. Namely, he observes the moon, via a telescope, at different times throughout the month and, upon seeing the lunar spots change in size and brightness in relation to the sunlight, he infers an uneven lunar surface; his inference relies, in part, on the analogous mountainous surface of the earth, which has similar changes in relation to the sunlight. Thus, as is often argued, analogical inference plays a key role in Galileo's logical process in concluding that the moon has an uneven surface (Shea, 2000; Spranzi, 2004). Furthermore, in that process, he sees simply spots on the moon that appear larger or smaller, lighter or darker. In short: he witnesses spots undergoing change.

The moon indeed appears spotted, and in different patterns, depending on its phase when viewed without a telescope. Anyone could therefore naturally expect to see such changes when using a telescope. However, it was only Galileo who monitored the spots' changing appearance. Although perhaps a cliché, one could say that it was thanks to his curiosity that Galileo attended to the alterations. However, I argue that it would be more precise to say that the changing appearance itself stimulated Galileo's curiosity. Originally, Galileo saw the ancient lunar spots as changeable and undetermined, that is, as lacking meaning and rationale, and that dearth took his mind to the moon. The impressionistic aspect of Galileo's sketches, in contrast to the still-life sense of Harriot's, may be attributed to the state of mobility in which Galileo felt the moon to be in while he was drawing it.

In subsequent passages, therefore, Galileo describes other observations, such as the lunar spots changing shape; here, he also relies on an analogy with what he observed about the earth. Turning his sight now to the dark part of the moon and on the same night observing the bright points that appeared to be "entirely separated and removed" from the bright part, he depicts their changing appearance thus:

> Gradually, after a small period of time, they are increased in size and bright ness. Indeed, after two or three hours they are joined with the rest of the bright part, which has now become larger. In the meantime, more and more bright points light up, as if they are sprouting, in the dark part, grow, and are connected at length with that bright surface as it extends farther in this direction. An example of this is shown in the same figure. Now, on Earth, before sunrise, aren't the peaks of the highest mountains illuminated by the Sun's rays while shadows still cover the plain? Doesn't light grow, after a little while, until the

> middle and larger parts of the same mountains are illuminated, and finally, when the Sun has risen, aren't the illuminations of plains and hills joined together? (p. 15)

In the dark part, the bright points get increasingly larger and, by joining with other parts, end up connecting to the bright part. Additionally, the way in which the bright points within the dark part change shape corresponds to the way the earth's high mountains change how they glow. Throughout the course of a day, the mountains begin to glow from the top early in the morning, and then they are gradually shrouded in complete brightness as the sun rises higher. Unlike the bright part, in which the dark spots change shape according to the principle of a concave shape illuminated by the sun from different positions, the dark part's bright points change shape according to the principle of a convex shape. However, they are all illuminated in the same way.

Galileo then depicts several more spots, which he observes changing shape according to the same principle. For example, when the moon is rushing toward its first quadrature, a bright peak below a vast dark gulf around the lower horn begins to rise. Gradually, that bright spot grows and assumes a triangular shape. At this point, because the moon is about to set, it is larger and not only joins with the rest of the bright part but is also surrounded by three bright peaks, thereby breaking out into the dark gulf (pp. 15-16). Regarding the large and ancient moon spots, Galileo says that they "are not seen to be filled with depressions and prominences, but rather to be even and uniform," and not because he saw them thus directly, but because he inferred this from the observed fact that "they are only here and there sprinkled with some brighter little places" (p. 16) on the principle of the contrastive composition of darkness and lightness on an uneven surface.

In addition, Galileo observes a large spot in the moon's upper part before the second quadrature, which he depicts to be "walled by some darker edges which, like a ridge of very high mountains turned away from the Sun, appear darker; and where they face the Sun they are brighter" (p. 18). Furthermore, regarding "a certain cavity larger than all others and of a perfectly round figure" observed around the moon's middle on the same day, Galileo writes:

> It offers the same aspect to shadow and illumination as a region similar to Bohemia would offer on Earth, if it were enclosed on all sides by very high mountains, placed around the periphery in a perfect circle. For on the Moon it is surrounded by such lofty ranges that its side bordering on the dark part of the Moon is observed bathed in sunlight before the dividing line between light and shadow reaches the middle of the diameter of that circle. But in the manner of the other spots, its shaded part faces the Sun while its bright part is situated toward the dark part of the Moon, which, I advise for the third time, is to be esteemed as a very strong argument for the roughnesses and unevennesses scattered over the entire brighter region of the Moon. (p. 20)

Galileo thus describes the cavity as having the shape of a big basin—a concave—as it shows either a shady or a sunny side depending on its position relative to the sun's light. When Galileo compares it to the earthly region of Bohemia, the earthliness of his descriptive language reaches its climax. However, Galileo's observations are still nothing more than spots, darker or lighter. As for the accuracy of his descriptions here, as the translator's note indicates, it is difficult to identify them exactly in the drawings (p. 63, no. 36). In fact, Galileo exaggerates the cavity's size when he compares it to the Bohemian basin (Shea ,1990, p. 56). Nor is he free of a wrong inference when, regarding the large and ancient moon spots that appear to be less steep, he interprets the darker, concave part in reference to the Pythagorean idea that the moon is another earth, as "represent[ing] the water surface" (p. 16). While these are certainly errors, they are not problematic because, as the translator argues, "It was not Galileo's purpose to make an accurate map of the Moon, but rather to illustrate its Earth-like nature" (p. 63, no. 36).

The advocates of the realism thesis do not neglect the importance of a certain kind of logical thinking in Galileo's lunar science. Bredekamp, as discussed above, is one leading figure that holds such a perspective. For him, drawing was not a mirror but "part of the penetrating analysis of what is visible" (2019, p. vii). For Filippo Camerota as well, knowledge of optics was a requirement for Galileo to interpret visual appearance (2004). While these arguments are quite sensible in certain ways, as for the logical process involved, the problem, lies in that they presuppose people already knew that the sun's light caused the contrast of dark and light. According to these perspectives, Galileo simply had to realize that the contrast indicates the moon's uneven surface on account of his artistic knowledge alone. On the contrary, in Galileo's time, it was controversial whether the moon is an illuminator or a reflector—let alone the relationship of the spots and the sunlight (Ariew, 2000, pp. 215–23). The moon's uneven surface was important to Galileo because it proved that the moon is a reflector rather than an illuminator. What is so important in Galileo's logical thinking is not simply how he discovered the uneven surface from what he had observed, but how he discovered it in such a way that he could argue for a heliocentric theory of the universe.[x]

To examine this question more closely—a question which seems to have more to do with the afore-mentioned analogical reasoning—I will briefly refer to Marta Spranzi's epistemological analysis of Galileo's process of analogical reasoning. Emphatically noting that Galileo's purpose was to show the moon and earth as belonging to the same ontological category, "planet" (i.e., that "the Earth is similar to the Moon" rather than the other way around), Spranzi reconstructs the main phases of Galileo's analogical thinking as follows:

> 1. We see on the Earth, and can have direct experience of mountains and plains illuminated by sun in different ways
>
> 2. By thought experiment we can imagine to be very far from the Earth (on the Moon for example) and to draw what we see by applying the laws of perspective
>
> 3. We can draw the different images of the spots we observe on the Moon through the telescope at different times of the month
>
> 4. We compare the two drawings (real and imaginary) and we realize that they are substantially similar, if not identical
>
> 5. By analogical reasoning we can conclude that the drawings we have of the Moon indicate the presence of mountains and of valleys on the Moon. (2004, p. 461)

Spranzi formalizes the analogical reasoning thus: "The drawings of the Earth mountains from afar (A) are to the Earth mountains (B) as the drawings of the Moon (C) are to the mountains of the Moon (D)" (ibid., p. 462).[xi]

Spranzi understands that, while Galileo's logical process seems natural and easy to follow, it actually involves an essential difficulty. As she argues cogently, the similarity of the drawings of the earth's mountains (A) and of the moon's spots (C) is not there at all because the drawings of the earth's mountains (A) are imaginary mountains, obtained by thought experiments. Further, she contends, even if there were any drawings, they would be quite different from those of the moon's spots (C), given the presence of the earth's atmosphere and its large oceans. Spranzi thus argues that Galileo adopts the strategy of using models and metaphors to make up for a nonexistent, apparent similarity. In other words, he constructs "a pseudo-picture, or didactic model" of a rugged surface that is strengthened by the metaphor, "mountains" (ibid., p. 469). According to Spranzi's argument, "mountains" are not a positive property of the moon but constitute a metaphor serving as a transitional link. In this sense, there is a certain kind of imagination, which I characterize as being metaphoric, that is involved in Galileo's logical process.

Spranzi is unique in explaining Galileo's analogical reasoning as both logical and imaginative, and I strongly concur on this point. However, she ought to have also considered the imagination at work in Phase 2. As Spranzi indicates, it is a sheer imaginary act to draw the earth's mountains from an astronomical distance, which, while not as natural as she seems to assume, is impossible without the imagination. The importance of the imagination in Phase 2, which I call self-distancing imagination, is affirmed by the fact that Galileo tries to show the ultimate ontological similarity of the moon and the earth by the similarity in their relationship to the sun, not by the similarity in their surface appearance. Spranzi writes that, while the surface property is the most relevant, "the relational property of reflecting the sun's rays so as to produce corresponding shadows is derivative on those other absolute properties" (ibid., p. 470). However, the relational property is already involved in Phase 2 and, I argue, is more relevant given that it is impossible to think of "compar[ing] the two drawings" in Phase 4 without the idea of the relational property in Phase 2. What is more, this relational property is essentially what Galileo infers, but it is also impossible to discover without Galileo's positioning himself, by his imagination, at a significant distance from both the moon and the earth.

The relevance of relational property and self-distancing imagination to Galileo's lunar science becomes clearer when Galileo explains the moon's ashen light. The ashen light, referred to as "earthshine" today, is the dim glow of the portion of the moon that is bathed in darkness, and one can observe it a few days before and after the new moon. This glow's source was highly disputed because it could be a possible discriminant between the different world systems (Molaro, 2013). Galileo calls this ashen light the "secondary brightness" (p. 27), borrowing the artistic notion that refers to reflected light, rather than direct light. Galileo's term clearly expresses his position regarding the issue. That is, his term denotes that the glow is neither the moon's own nor imparted directly by the sun or stars. Rather, it originates from a third source that illuminates the moon by reflecting light. Galileo supports his theory by arguing that, first, based on direct observation, the moon's light changes irrespective of the sun's light. For instance, it is brighter and whiter during an eclipse, but is diminished when the moon, going toward quadrature, receives the sunlight on its half area (pp. 27, 28). Second, based on the relational properties of heavenly bodies, Galileo excludes Venus from the list of candidates because "near conjunction and within the sextile aspect it is entirely impossible for the part of the Moon turned away from the Sun to be seen from Venus" (p. 28). Third, as for the real source of the glow and again based on relational properties, he proposes that "since in the vastness of the world no other body, therefore, remains except the Earth, the lunar body or some other dark and gloomy body is bathed by light from the Earth" (p.

28). Galileo could see only spots even when using a telescope. As such, it is both inevitable and indispensable to depend on relational properties to prove his theory, which is after all a theory of a new cosmic relationship. Furthermore, because these properties are intermediated by light, it seems that what Galileo had pursued all the way, through means of the telescope, was light more than it was the moon. Thus, his observation ultimately redefines the earth as a mediator of light, and the mode of thinking required by the observer in the process would therefore be self-distancing imagination. Only by this means could one cease a fixating on systemizing qualities, such as the origin, the first, and the center of the universe. Immediately after this discussion, and probably to quell any expected surprise, Galileo appeals to the naturalness of "an equal and grateful exchange" of light in which "the Earth pays back the Moon with light equal to that which she receives from the Moon almost all the time." The moon and the earth stand like sisters alone "in the deepest darkness of the night" (p. 28). It would thus be reasonable to understand that this passage's unique sentimentality belongs to Galileo himself, who may have felt alone, longing for a new love in the midst of his own position of detachment.

In the next section, I will explore how this self-distancing imagination, which involves re-establishing the relationship of objects through light, is connected to artistic sensibility through the lens of Lacan's art theory. For that, I will begin with discussing the Lacanian notion of subjectivity, with which his art theory is closely related.

3. The Split Between the Eye and the Gaze and the Light for the Gaze: The Scientist's Imagination

Lacan's foundational proposition about subjectivity is that human subjectivity is an effect of symbolic construction and, as such, it is inherently split. We, as beings born in a material body, are not necessarily subjects. Rather, we come into being as subjects as far as we survive the animalistic and materialistic conditions of existence through an entry into the symbolic order of things, which is a system of representing the world through language's signifying function. Once we accept the symbolic system of language, we no longer live life in its materialistic reality but in its meaningful representation, thereby obtaining our subjectivity as an effect of our engagement in the symbolic process of representation as producers and consumers of meaning.

Via this entry to the symbolic order, then, a fundamental otherness intervenes in the existence of the subject, who now experiences the world by the third-worldly medium of language. The subject suffers from a structural limit in his or her existence because the symbolic system (i.e., a structure in which the signifier alone does not have a positive meaning but acquires meaning by virtue of its difference from the others) always fails to provide the signifier of an ultimate meaning. From the Lacanian viewpoint, the subject is always a split subject because of this internal deficit in the symbolic system. Likewise, this is what the Freudian concept of castration means, according to Lacan, for the subject, who is haunted by the feeling that there is a lack in the midst of symbolic engagement. Lacan argues that we have no choice but to accept the symbolic order of things, despite this defect, just like meeting a burglar who threatens us to give up either our money or our life, we have no choice but to choose life and give up the money (1979, pp. 212-13).

This split is, however, both a curse and a blessing for the subject. Because the symbolic order cannot provide perfect satisfaction given its inherent lack, the subject is alienated from him- or herself within the symbolic order. However, this alienation also means that the subject maintains a certain distance from the signifying function of language. While the lack causes alienation by the very fact that no one within the system can provide the ultimate answer to his or her life, it also allows the subject to have space from the stifling meaning structure of everyday life. Eventually, the subject intervenes in the world with some autonomy. Instead of being alienated, the subject, now separated, actively desires to fill the void in the fantasy of recovering the lost 'realness' of life. Lacan links this process to the register of will, of "want to be" (ibid., pp. 29, 281), in distinction to the register of the existential necessity of alienation. The split is, as it were, the force that drives the subject to seek satisfaction, amidst such paucity, on the wheels of desire, which run by the double movement of alienation and separation.

The split in subjectivity appears in the form of a split between the eye and the gaze in the field of vision. According to Lacan, the subject sees objects through the dual structure of the eye and the gaze. The former is the visual mode by which the subject sees an object as a thing having a stable, unified existence in a self-mirroring manner as if one recognizes oneself as a coherent, ideal ego in a mirror. The subject of representation comes into being in this way and appears to achieve a sense of mastery in vision as he represents the world in unified images. The latter refers to the mode by which the subject's vision is split as he encounters a certain materiality of existence that resists the unifying function of symbolic representation. Lacan describes the gaze as visiting the subject in the form of the uncanny, which emerges when the object the subjects looks at is somehow looking back at him and he therefore becomes conscious of his own narcissistic power of vision. The subject, alienated from his own representational activity, feels like he himself is being looked at from the outside. Instead of picturing the world, in the mode of the gaze, the subject feels as though he is being turned into a picture seen by another. The gaze is the eye outside "imagined by me in the field of the Other" (ibid., p. 84).

Lacan describes the eye and the gaze as "intertwined," "interlaced," and "intersected" (ibid., pp. 93, 95) in the sense that the two dimensions, though different, form a single structure in which two contradictory elements are superimposed in a mutually interfering relationship (see Fig. 5). Because of this superimposed structure, as Lacan explains, the retina functions more like a screen that renders the correspondence between the image and the object unstable and opaque and less like a canvas that allows for a stable correspondence. To adopt a Lacanian metaphor, while the eye may be compared to the straight line of vision—like that of geometrical vision—the gaze may be compared to the oblique or curved line of vision because it refracts or diffuses the formulating function of the eye (ibid., pp. 103, 106, 147). The two are essential constituents of the visual domain. Or, when considering existential necessity, the gaze may be said to be parasitic to the eye, not vice versa. As Lacan writes: the gaze is presented to us "only in the form of a strange contingency, symbolic of [. . .] the lack that constitute castration anxiety" (ibid., pp. 72–73).

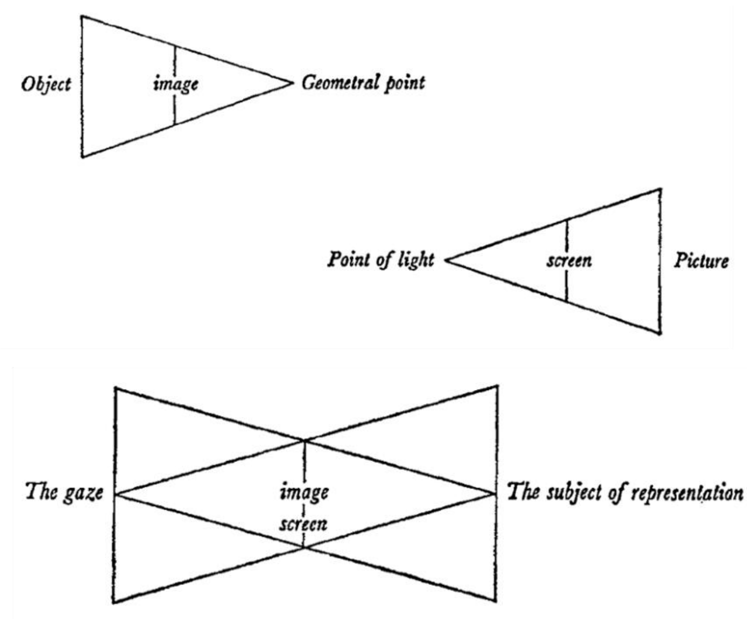

Figure 5: Lacan, schemas on the field of vision (1979, pp. 91, 106)

Light is the key point at which one encounters the gaze. Lacan explains this with a personal anecdote. When he was a young and ambitious scholar, Lacan went to a fishing village to cool his head and rejuvenate. While there, he boarded a boat with a group of fishermen. Then, while out at sea, a man named Petit-Jean pointed out something floating on the waves: a tuna can glittering in the sun's light. Petit-Jean then said to Lacan, "You see that can? Do you see it? Well, it doesn't see you." It was a hilarious joke, and it was meant to be at the expense of Lacan because he was too serious to fit into their way of life. Lacan recalls feeling a strange sense of alienation at that moment.

> If what Petit-Jean said to me, namely, that the can did not see me had any meaning, it was because in a sense it was looking at me, all the same. It was looking at me at the level of the point of light, the point at which everything that looks at me is situated. [. . .] I [. . .] looked like nothing on earth. In short, I was rather out of place in the picture. (ibid., pp. 95-96)

The joke awakened the sense of an unfamiliar gaze having watched him, despite being unaware of it because he had been self-absorbed. The can, because of its glittering light, reminded him of the presence of something external that seemed to be looking back at him. As such, it shocked him out of himself and led him to the point at which he felt as if he were nothing, being out of place in the scene of his own life.

Lacan's explanation of light differs from the mathematically based account (as explained by perspective). According to the latter, perspective is the technique of representing an object in three-dimensional semblance by positing it on geometrically scaled lines that indicate different distances from the viewer. This three-dimensional semblance is completed by adding to the figure corresponding shadows created by the volume of the object when exposed to light. As a result, light plays a vital role in perspective because it renders the true reality of objects, as it is believed that light makes the objects entirely visible. However, according to Lacan, light is not integral for the reasons proponents of perspective claim because, once hearing the geometrical rules of representing an object in perspective, even a blind man incapable of seeing light can master them. Anyone can draw straight lines in the dark (ibid., pp. 198, 86). Rather, light is important because it creates an ambiguity that has the effect of turning a picture into something other than itself.

> That which is light looks at me, and by means of that light in the depths of my eye, something is painted—something that is not simply a constructed relation, the object on which the philosopher lingers—but something that is an impression, the shimmering of a surface that is not, in advance, situated for me in its distance. This is something that introduces what was elided in the geometral relation—the depth of field, with all its ambiguity and variability, which is in no way mastered by me. It is rather it that grasps me, solicits me at every moment, and makes of the landscape something other than a landscape, something other than what I have called the picture. (ibid., p. 96)

In this passage, which is just as ambiguous as the topic being addressed, Lacan explains the paradoxical correspondence of light and ambiguity. People tend to think that light, because of its illuminating function, is the medium by which things reveal their true identities. Rather, in a Lacanian view, light actually increases ambiguity: light engenders our sense of fascination about the objects around us and compels us to ask what they are. In an even more radical turn, Lacan argues that the objects are not even necessarily there; they only come into being in the way that we, having become prisoners of light, ask what they are. To repeat some of the words above, light, as the point of the gaze that "looks at me," is the medium by which, "an impression, the shimmering of a surface" is depicted in our eye. Light in a picture likewise introduces "the depth of the world, with all its ambiguity and variability," making of the landscape "something other than a landscape." According to an ancient Greek anecdote, the painter Parrhasius, who drew a veil on a canvas, overpowered Zeuxis, who drew perfect grapes; Parrhasius had allured his counterpart by making Zeuxis ask him to lift the veil and show the object behind it (Pliny, [circa AD67] 2020, p. 249; Lacan, 1979, pp. 103, 111). The successful picture is not one that creates a realistic representation; rather, it is what makes one ask, "What is behind it?" As the point where one encounters the gaze, in extreme terms, light—not the object—is the real source of representation, from which reflections come forth.

Lacan argues that the gaze was already present in perspective when the importance of light to a picture was discovered. The painting, *The Ambassadors*, by the sixteenth-century German painter Hans Holbein, depicts two ambassadors and a selection of scientific instruments in realistic detail. However, an elongated object, which turns out to be a cuttlefish bone with an image of a skeleton, is drawn obliquely on the bottom center. This object looks simply like an unidentifiable stain when one views it from the front, but it arrests one the moment one turns one's head and obliquely looks at it, wondering, "What is that?" By creating an anamorphosis image that captures the viewer with its very ambiguity, the painter responded to the viewer's gaze in his own way—reminding us of "our own nothingness" (Lacan, 1979, p. 92). Just as the mode of vision that always participates in "the ambiguity of the jewel" (ibid., p. 96), so too does the gaze inhere in every picture, by means of light, with the capacity to fascinate us about our world.

Galileo's artistic sensibility that benefited his lunar science corresponds to the dimension of the gaze in the field of vision. Galileo's scientific discovery began with seeing the lunar spots, which he refused to see within the frame of traditional representation. For him, the spots were nothing other than an anamorphosis of the moon, like a stain in a painting that works to undercut the unifying function of symbolic representation. With his perception of the moon as anamorphic, Galileo questioned what the spots were and, with that question, was captivated by the moon. In a Lacanian sense, it is notable that people had compared the moon to a crystal ball before Galileo because a crystal ball is like a mirror in which one's narcissistic identification with one's own reflected image occurs. It also supports the unifying function of the eye as it reflects one's self-image. The lunar spots, as Galileo recognized, facilitated the undoing of the narcissistic absorption in his vison by rendering the supposedly mirrored surface of the moon as, in fact, stained.

Galileo's analogical reasoning regarding the cosmological implications of the lunar spots is another instance where the gaze is involved. The core inference Galileo made from his observation of the spots is that the sun does not shine only on the Earth, but it also shines equally on the moon. In short, the Earth and the moon are in a homogeneous relationship with the sun. Standing on the earth, Galileo could discover this relationship only when he looked at the sun from the position that "the picture, certainly, is in my eye. But I am not in the picture" (ibid., p. 96). The sun's light became a medium that no longer highlighted Galileo as being on the earth but looked back at him from the outside, under which Galileo felt like being nothing and out of place. Given that Galileo was an artist, he discovered this new cosmic topology by imagination first rather than by mathematical formula. Because of the concept of "aesthetic distance" in aesthetic theory, which refers to a psychological state of disinterest or detachment an artwork creates in the viewer's mind through objectifying framing, this externalized look or self-distancing imagination is inherent to all the arts. However, as far as it operates in the scopic field by means of light, one can say it is unique to pictorial art.

4. *Objet a* as the Real Thing: The Scientist's Ethics

As the visual dimension that hinders the unifying function of the symbolic order, the gaze is also the point where the subject encounters a paucity in the symbolic process of representation. The subject feels that something is lacking in everyday engagement with symbolic representation through the gaze's oblique look. This sense of deficit causes his desire of separation, a desire to transgress the inadequacy of the symbolic order for the possibility of complete satisfaction. *Objet a*, the real thing that the subject desires when representation fails to deliver the fantasy of recovering the subject's lost real life, is what triggers this dialectic interaction of lack and the desire of separation. The "*a*" stands for the French word "autre," which means "other" in English. Thus, *objet a* means "other object(s)"; in fact any other object that could fill the lack in the symbolic order. Notably, Lacan insists on writing the phrase in lowercase to distinguish it from the capital "Other," the fundamental "Otherness" in relation to which the subject is necessarily alienated. He also opts for lowercase to leave it untranslated, thereby giving it "the status of an algebraic sign" (Sheridan, 1977, p. xi), like a signifier without substantial meaning. For Lacan, *objet a* refers to numerous little objects that are separated from the one "Thing," which constantly catalyzes the subject's desire to be in continuous exchange with another. It is often called "the object-cause of desire," the ultimate thing that causes desire but is also literally a cause, a thing of impossibility that fascinates because of its very impossibility. For this reason, it is also lethal. According to Lacan, the subject, particularly the artistic subject, is the one who pursues this real object—even to his death—according to his desire of separation. While the domains of systematic knowledge masquerade as completeness repressing the lack by means of the signifier of the Master Other, art is distinguished by acknowledging the dearth in representation through the gaze and seeking to embody the thing beyond. In the case of pictorial art, this is achieved through the new composition of images.

The gaze, as the visual dimension with a transcendental drive, is open to sublimation. To sublimate is to separate an object from the fixity of its everyday representation and "[raise] the object [. . .] to the dignity of the Thing" (Lacan, 1992, p. 112). Sublimation occurs independently of the object but dependently on how the object is positioned in relation to the subject. The work *Fountain*, by the French artist Marcel Duchamp, exemplifies Lacanian sublimation well. Duchamp displayed a readymade urinal at an exhibition of the Society of Independent Artists in New York in 1917. This displaced object, which disrupted the discursive order, induces the viewer to see it as something other than itself. Furthermore, it triggers the viewer's gaze to land on the void created by everyday representation, thus leading the gaze to look beyond the surface level where things stand on their own right. In terms of elevating an object to the level of the "real" through disrupting its fixed image, the gaze is nothing other than the love for an object with a lack.

For Galileo, the moon is akin to *objet a*. Given that his discovery began with seeing the lunar spots as unidentifiable things, the moon indicates the point where traditional representation failed, which incites his desire of separation for that some place beyond. Galileo's drive for separation is demonstrated by the first action he takes with regard to the moon in *Sidereus Nuncius*, which is naming it. By dividing the moon's face into its brighter and darker parts—like God separating the light from the darkness, Galileo declares he "will call [certain spots] the large or ancient spots" (p. 13). Also, "as I[Galileo] call it," the ashen light is "the secondary brightness." Galileo repeats this act of naming when he discovers Jupiter's four moons naming them after the four brothers of his patron, Cosimo II de' Medici. In other words, for Galileo, it was as if the entire universe had emerged as an object awaiting new representation.

Galileo's gaze on the "real" moon was accompanied by its sublimation. The moon, a celestial object of beauty in traditional representation, is not beautiful in that sense any longer, but the dominant emotion he felt for it was an appreciation of its beauty. This resulted from the sublimity in the way that the moon is positioned in relation to Galileo. For him, "it is most beautiful and pleasing to the eye to look upon the lunar body [. . .] from so near as if it were distant by only two of these measures" (p. 9), and the diverse patterning in the appearance of larger spots "does happen beautifully in the other, smaller, spots occupying the brighter part of the Moon" (p. 21). For Galileo, the moon is beautiful not because of its representational properties but because of the intimacy and dynamism that Galileo personally feels about the moon. The moon, when separated from the grand social discourse, becomes for Galileo such a personalized object as to take the dignity of the Thing as it stands in its own right. Similarly, the fact that the earth is no longer believed to be at the center of the universe is another source of sublimity for Galileo. For him, the earth is now "not the dump heap of the filth and dregs of the universe"; together with the moon, and both being reflectors, the earth is not "to be excluded from the dance of the stars" (p. 30). By discovering the scientific fact that the earth and the moon do shine, but only by reflecting the sun's light, Galileo turns a potentially tragic story into a narrative with a grand cause. Both the moon and the earth, each displaced in its own way, stand as objects deprived of their traditional meaning and, as such, are sublimated as objects with the dignity of the Thing: they may be objects with a lack but they are real things for that reason.

On publishing *Dialogue Concerning the Two Chief World Systems: Ptolemaic & Copernican* in 1632, which defended heliocentrism more explicitly, Galileo, persecuted early on, was finally put on trial by the Roman Catholic Inquisition. According to records, he submitted to reading the formula of abjuration, which required him to swear: "I abjure, curse, and detest the above-mentioned errors and heresy" (Galileo, [1633] 1989, p. 292). The "Galileo Affair" has sparked much debate on the ethics of a scientist. Questions have arisen, such as, Was Galileo a betrayer or a victim? The matter becomes even more complex because, after the Inquisition and while being under house arrest, Galileo continued his research and contributed greatly to the advancement of modern physics by publishing a compilation of his studies in *Discourses and Mathematical Demonstrations Relating to Two New Sciences* in 1638. Was Galileo not a realist who knew how to compromise for a greater cause? The multivalence of Galileo's behavior calls for a new perspective, particularly regarding his psychological consistency. Apart from his friction with society, what enabled Galileo to remain true to himself as a scientist? Finally, what ought the ethics of a scientist be?

I suggest that Galileo's commitment to science was not about truth, but rather about *objet a* as the cause of his academic desire. For Galileo, science is not the pursuit of truth, which is something yet to be established, feigning completeness, in a specific era under specific conditions of meaning structure: in Galileo's words, unlike a scientist, philosophers seek truth "not in the universe, not in nature, but (I use their own words) by comparing texts!" (Galileo, [1610] 2021; parentheses in the original). Science is rather an attitude of love toward numerous little objects in nature as the real materiality of the world. Scientists are constantly desiring to encounter the "real" of an object without settling on a specific truth. As Galileo says, "in order to banish the opinion in question [heliocentrism] from the world," it is insufficient to stop the mouth of each single man, but it is necessary to "ban the whole science of astronomy" and "to forbid men to look at the heavens" (Galileo, [1615] 1989, p. 102). Galileo could give up the theory as long as he gave up the truth; but he could not give up the countless objects of the universe. If we can identify any ethical coherency that could keep Galileo true to himself among the seeming contradictions in his behavior in conflict with society, it is his love for *objet a*.

Declaration of Conflicts of Interests

No potential conflicts of interest.

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Notes:

[i] One prominent theory was that the moon’s imperfections were created by the different densities of its smooth body. Another rationale was that the imperfections were the result of the reflection of the earth’s mountains and oceans upon the flawless orb of the moon (Ariew, 1984; Ostrow, 1996).

[ii] The seven watercolors were reproduced by Galileo on two separate sheets (6 in the first, 1 in the second).

[iii] It is known that Harriot's telescope was of a 6x magnification while Galileo 's, used for *Sidereus Nuncius*, was of a 20x magnification.

[iv] Stephen Pumfrey lately argued that, on observing the moon, Harriot had a different scientific aim, which was to observe the phenomenon of lunar libration on the basis of his moon map (Pumfrey, 2009, pp. 163–68). However, as pointed out by many scholars, the problem with Harriot’s drawing is that it was of a lower quality than the pictures of the moon painted by artists more than a century ago, like Jan van Eyck and Leonardo da Vinci (Bredekamp, 2000, p. 177; Reaves and Pedretti, 1987; Montgomery, 1994).

[v] Cigoli's last work, the fresco *Assumption of the Virgin* in the Pauline Chapel of the Vatican City, depicts Mary on a rugged moon. It is well-accepted that this work was inspired by Galileo's scientific findings (Panofsky, 1956, pp. 3–4; Ostrow, 1996; Cooke, 1999).

[vi] See Ariew, 1984, p. 214 for a brief mention of this.

[vii] Edgerton acknowledges Lacan’s importance in these terms; and yet, he defers covering the issue (1991, p. 5, no. 9).

[viii] Panofsky’s practical criticism is based on Galileo’s letter to Cigoli dated 26 June 1612. The authenticity of this letter has been doubted (Finocchiaro, 2011).

[ix] Hereafter, all quotes from *Sidereus Nuncius* are, unless otherwise noted, from Galileo Galilei, [1610] 1989, *Sidereus Nuncius or Sidereal Messenger*, trans., Albert Van Helden, Chicago: The University of Chicago Press. Only page numbers will be noted in the text below for the sake of brevity.

[x] In this respect, I strongly agree with Roger Ariew that Galileo’s demonstration of the existence of the moon’s mountains could not demolish the foundations of the Aristotelian cosmology unless he first proved that the moon shines by reflecting the sun’s light (Ariew, 1984, pp. 225–26).

[xi] I have replaced the Arabic numerals in the original with letters of the alphabet to distinguish them from the numerals in the list above.

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